Reg. No.												

Question Paper Code	12436

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Fifth Semester

Electronics and Communication Engineering

20ECEL508 - CONTROL SYSTEMS ENGINEERING

(Provide Graph, Polar sheet and Semilog sheet)

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

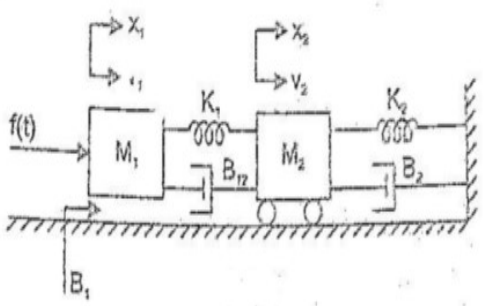
Answer ALL Questions

		Marks, K-Level, CO
1.	Distinguish between open loop and closed loop system.	*2,K1,CO1*
2.	Write the analogous electrical elements in force-current analogy for mechanical translational system.	*2,K1,CO1*
3.	Define non-touching loop.	*2,K1,CO2*
4.	Identify the advantages of state variable model.	*2,K1,CO2*
5.	A second order system has the following properties ξ = 0.5, ω_n = 10 rad/sec. Express the transfer function of the system.	*2,K2,CO3*
6.	Distinguish between type and order of a system.	*2,K1,CO3*
7.	Write the formula for centurion of the asymptotes found in root locus technique?	*2,K2,CO5*
8.	State Nyquist stability criterion.	*2,K1,CO5*
9.	Derivative controllers are not used control system. State the reason.	*2,K1,CO6*
10.	Draw the circuit of the lead compensator and draw its pole zero diagram.	*2,K1,CO6*

PART - B (5 × 13 = 65 Marks)

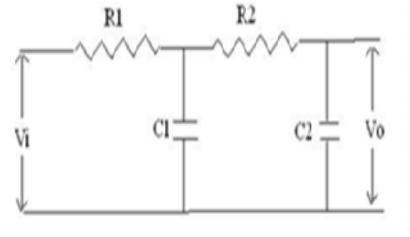
Answer ALL Questions

11.	a)	Draw the force voltage and force current analogous circuit of the mechanical system shown below.	*13,K2,CO1*

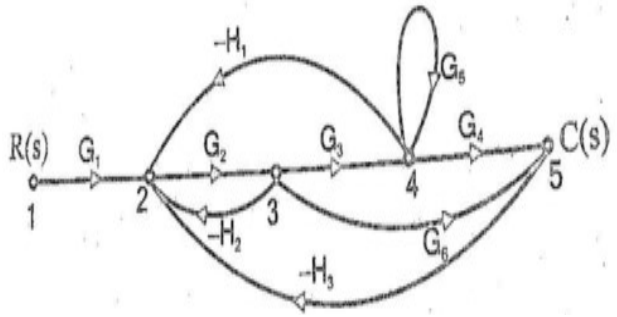


OR

b) Determine the transfer function of the network in fig. *13,K2,CO1*



12. a) Obtain the transfer function for the signal flow graph shown in figure. *13,K2,CO2*



OR

b) Determine the transfer function for the system which is represented in state space representation as follows *13,K2,CO2*

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -2 & 1 & 0 \\ 0 & -3 & 1 \\ -3 & -4 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

13. a) Derive the response of the under damped second order system for unit step input. *13,K2,CO3*

OR

b) (i) A unity feedback system $G(s) = \frac{K_1(2s+1)}{s(5s+1)(1+s)^2}$. When the input r (t) = 1+6t, determine the minimum value of K_1 so that the steady state error is less than 0.1. *6,K2,CO3*

(ii) Consider a unity feedback system with closed loop transfer function $\frac{C(s)}{R(s)} = \frac{Ks+b}{s^2+as+b}$. Determine the open loop transfer function G(s). Obtain its steady state error with unit ramp input. *7,K2,CO3*

14. a) Apply Routh array and determine the stability of the system represented by the characteristic equation, *13,K3,CO5*

$$S^5+S^4+2S^3+2S^2+3S+5= 0.$$

Comment on the location of characteristic equation.

OR

b) Sketch the root locus of the system whose open loop transfer function is G(s)= $\frac{K}{s(s+2)(s+4)}$. Find the value of K so that damping ratio of the closed loop system is 0.5. *13,K3,CO5*

15. a) Discuss the procedure adhere to device a lag compensator using bode plot. *13,K3,CO6*

OR

b) Analyze a phase lead compensator for the system G(S) =$\frac{K}{s(s+1)}$ to satisfy the phase margin ≥ 45°,steady state error for a unit ramp input ≤ 1/15 and gain crossover frequency <7.5 rad/sec. *13,K3,CO6*

PART - C (1 × 15 = 15 Marks)

16. a) Sketch Bode plot for the following transfer function and determine the system gain K for the gain crossover frequency to be 5 rad/sec.$G(s) = \frac{Ks^2}{(0.02s+1)(0.2s+1)}$ *15,K3,CO4*

OR

b) The loop transfer function of a certain control system is given by G(s) H(s) =$\frac{K}{(s+2)(s+10)}$). Sketch the Nyquist plot and hence calculate the range of values of K for stability. *15,K3,CO4*